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Chapter

Introductory Chapter: Prognostics - An Overview

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1. Introduction

Prognostics, in general, can be defined as "knowledge beforehand". Prognostics is usually identified with medical issues. Nowadays, due to the new advances in technologies and information systems, prognostic is beginning to be employed in other fields, e.g. engineering, financial, business, etc.

The main key indicators are given by European Standard EN 15341:2007 [1]. The objectives of the key indicators are to measure the status, compare (internal and external benchmarks), diagnose (analysis of strengths and weaknesses), identify objectives and define targets to be reached, plan improvement actions and continuously measure changes over time. There are three main groups of indicators: economic [2], technical [3] and organisational [4]. They are set considering endogenous (company culture, industry, life cycle of the components, criticality, etc.) and exogenous (location, society culture, market, laws, regulations, etc.) variables [5].

Prognostics requires also of advance analytics in order to format, save and analyse these signals and information, from qualitative and quantitative points of view. *Model-based approach* takes into account the state prediction achieved through physics or system models, the following being mainly employed: model based on detection and isolation [6]. Hybrid models, extended Kalman filtering and particle filtering [7, 8]. *Data-driven approach* is also a state prediction with criteria evaluation, where the state prediction is achieved through regression or stochastic process modelling. The most important are autoregressive moving average (ARMA) or autoregressive integrated moving average (ARIMA) [9], etc.

Nowadays the information from an item or person is getting more and more, with more variables, complex, etc. The large amount of data requires to be analysed, considering the heterogeneity, noise accumulation, spurious correlations, and incidental endogeneity of the data. It does that new approach and algorithms based on artificial intelligence which will be appearing; Artificial Neural Network [10]; Fuzzy Logic System [11]; Hidden Markov Model [12]; Support Vector Machine [13], Relevance Vector Machine (RVM); Gaussian Process Regression [14], Multivariate Logistic Regression in general form, K-Means Clustering, Fuzzy Logic-Based Algorithms and Bayesian Belief Network, etc. Some algorithms can be applied together with the above-mentioned methods, e.g. gradient descent, alternating least squares, collaborative filtering, SVM kernel, belief propagation, matrix factorization and Gibbs sampling.

The next generation of approaches will require to process Big Data. Big Data is one of the central and influential research challenges for the 2020 Horizon, where the quantity of world data will be 44 times bigger in the next few years (0.8–35 zettabytes) [15].

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